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<110> E. I. du Pont de Nemours and Company

<120> Membrane-Bound Desaturases

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<150> 60/110,784
<151> 1998-December-03

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<213> Picramnia pentandra

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<211> 448
<212> PRT
<213> Picramnia pentandra

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Ile Ser Lys Trp Thr Lys Glu His Pro Gly Gly Glu Leu Pro Leu Leu
        35                  40                  45

Ser Phe Ala Gly Gln Asp Val Thr Asp Ala Phe Ile Ala Tyr His Pro
    50                  55                  60

Gly Thr Ala Trp Gln Tyr Leu Asp Arg Phe Phe Thr Gly Tyr Tyr Val
65                  70                  75                  80

Gln Asp Tyr Ser Val Ser Glu Met Ser Lys Asp Tyr Arg Arg Leu Val
                85                  90                  95

Ser Glu Phe Ser Lys Met Gly Leu Phe Lys Thr Pro Gly Lys Gly Val
            100                 105                 110

Tyr Cys Ser Ile Phe Phe Val Ser Val Leu Phe Ala Leu Ser Val Tyr
        115                 120                 125

Gly Val Leu Tyr Cys Lys Ser Thr Trp Ala His Leu Cys Ser Gly Leu
    130                 135                 140

Leu Met Gly Met Leu Trp Leu Gln Ser Gly Trp Val Gly His Asp Ser
145                 150                 155                 160

Cys His Tyr Gln Val Met Pro Asn Arg Lys Leu Asn Arg Leu Phe Gln
                165                 170                 175

Ile Ile Ala Gly Asn Val Ile Ala Gly Val Ser Val Ala Trp Trp Lys
            180                 185                 190

Leu Asp His Asn Thr His His Phe Ala Cys Asn Ser Ala Asn Leu Asp
        195                 200                 205

Pro Asp Ile Gln His Leu Pro Ile Ile Ala Ile Ser Pro Lys Phe Phe
    210                 215                 220

Asn Ser Leu Thr Ser Tyr Tyr His Asn Cys Lys Met Thr Tyr Asp Arg
225                 230                 235                 240

Ala Ala Arg Phe Phe Val Ser Phe Gln His Trp Thr Phe Tyr Pro Ala
                245                 250                 255

Leu Leu Ser Val Arg Leu Tyr Leu Phe Ile Leu Ser Phe Lys Val Val
            260                 265                 270

Phe Ser Asn Asn Lys Arg Val Tyr Lys Arg Ser Gln Glu Ile Leu Gly
        275                 280                 285

Tyr Ala Ala Phe Leu Thr Trp Tyr Ser Leu Leu Leu Ser Arg Leu Pro
    290                 295                 300

Asn Trp Pro Glu Arg Val Met Tyr Phe Thr Ser Cys Leu Ala Val Ala
305                 310                 315                 320
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Gly Phe Gln His Trp Gln Phe Ser Leu Asn His Phe Ala Ser Asn Val
                325                 330                 335

Tyr Thr Gly Leu Pro Ser Gly Asn Asp Trp Phe His Gln Gln Thr Lys
            340                 345                 350

Gly Thr Leu Asn Ile Thr Ala Ser Ala Trp Trp Asp Trp Phe His Gly
        355                 360                 365

Gly Leu His Phe Gln Ile Glu His His Leu Phe Pro Arg Met Pro Lys
    370                 375                 380

Cys His Phe Arg Lys Ile Ser Pro Ile Val Asn Lys Leu Cys Gln Lys
385                 390                 395                 400

His Asn Leu Ser Tyr Glu Thr Ala Thr Met Trp Glu Ala Asn Lys Met
                405                 410                 415

Val Tyr Ser Thr Leu Arg Ala Val Ala Met Glu Ala Lys Asp Val Thr
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Lys Pro Val Pro Lys Asn Met Val Trp Glu Ala Met Asn Thr Phe Gly
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<212> DNA
<213> Zea mays

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<211> 462
<212> PRT
<213> Zea mays

<400> 4

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Ala Gly Asp Val Arg Met Ile Ser Ser Lys Glu Leu Arg Ala His Ala
             20                  25                  30

Ser Ala Asp Asp Leu Trp Ile Ser Ile Ser Gly Asp Val Tyr Asp Val
         35                  40                  45

Thr Pro Trp Leu Pro His His Pro Gly Gly Asp Leu Pro Leu Leu Thr
     50                  55                  60

Leu Ala Gly Gln Asp Ala Thr Asp Ala Phe Ala Ala Tyr His Pro Pro
 65                  70                  75                  80

Ser Ala Arg Pro Leu Leu Arg Arg Phe Phe Val Gly Arg Leu Ser Asp
                 85                  90                  95

Tyr Ala Val Ser Pro Ala Ser Ala Asp Tyr Arg Arg Leu Leu Ala Gln
            100                 105                 110

Leu Ser Ser Ala Gly Leu Phe Glu Arg Val Gly Pro Thr Pro Lys Val
        115                 120                 125

Gln Leu Val Leu Met Ala Val Leu Phe Tyr Ala Ala Leu Tyr Leu Val
    130                 135                 140

Leu Ala Cys Ala Ser Ala Trp Ala His Leu Leu Ala Gly Gly Leu Ile
145                 150                 155                 160

Gly Phe Val Trp Ile Gln Ser Gly Trp Met Gly His Asp Ser Gly His
                165                 170                 175

His Arg Ile Thr Gly His Pro Val Leu Asp Arg Val Val Gln Val Leu
            180                 185                 190

Ser Gly Asn Cys Leu Thr Gly Leu Ser Ile Ala Trp Trp Lys Cys Asn
        195                 200                 205

His Asn Thr His His Ile Ala Cys Asn Ser Leu Asp His Asp Pro Asp
    210                 215                 220

Leu Gln His Met Pro Leu Phe Ala Val Ser Pro Lys Leu Phe Gly Asn
225                 230                 235                 240

Ile Trp Ser Tyr Phe Tyr Gln Arg Thr Leu Ala Phe Asp Ala Ala Ser
                245                 250                 255

Lys Phe Phe Ile Ser Tyr Gln His Trp Thr Phe Tyr Pro Val Met Cys
            260                 265                 270
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Ile Ala Arg Ile Asn Leu Leu Ala Gln Ser Ala Leu Phe Val Leu Thr
275 280 285

Glu Lys Arg Val Pro Gln Arg Leu Leu Glu Ile Ala Gly Val Ala Thr
290 295 300

Phe Trp Ala Trp Tyr Pro Leu Leu Val Ala Ser Leu Pro Asn Trp Trp
305 310 315 320

Glu Arg Val Ala Phe Val Leu Phe Ser Phe Thr Ile Cys Gly Ile Gln
325 330 335

His Val Gln Phe Cys Leu Asn His Phe Ser Ser Asp Val Tyr Val Gly
340 345 350

Pro Pro Lys Gly Asn Asp Trp Phe Glu Lys Gln Thr Ala Gly Thr Leu
355 360 365

Asp Ile Leu Cys Ser Pro Trp Met Asp Trp Phe His Gly Gly Leu Gln
370 375 380

Phe Gln Ile Glu His His Leu Phe Pro Arg Leu Pro Arg Cys His Leu
385 390 395 400

Arg Lys Val Ala Pro Ala Val Arg Asp Leu Cys Lys Lys His Gly Leu
405 410 415

Thr Tyr Ser Ala Ala Thr Phe Trp Gly Ala Asn Val Leu Thr Trp Lys
420 425 430

Thr Leu Arg Ala Ala Ala Leu Gln Ala Arg Thr Ala Thr Ser Gly Gly
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Ala Pro Lys Asn Leu Val Trp Glu Ala Val Asn Thr His Gly
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<212> DNA
<213> Glycine max

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<212> PRT
<213> Glycine max

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Ala Ala Ser Ser Asp Tyr Arg Lys Leu Phe Ser Asp Leu Ser Ala Leu
             20                  25                  30

Asn Leu Phe Asn Arg Lys Gly His Thr Thr Ser Ile Leu Leu Ser Leu
         35                  40                  45

Ile Leu Thr Leu Phe Pro Leu Ser Val Cys Gly Val Leu Phe Ser Asp
     50                  55                  60

Ser Thr Phe Val His Val Leu Ser Ala Ala Leu Ile Gly Phe Leu Trp
 65                  70                  75                  80

Ile Gln Ser Gly Trp Ile Gly His Asp Ser Gly His Tyr Asn Val Met
                 85                  90                  95

Leu Ser Arg Arg Leu Asn Arg Ala Ile Gln Ile Leu Ser Gly Asn Ile
            100                 105                 110

Leu Ala Gly Ile Ser Ile Gly Trp Trp Lys Trp Asn His Asn Ala His
        115                 120                 125

His Ile Ala Cys Asn Ser Leu Asp Tyr Asp Pro Asp Leu Gln His Met
    130                 135                 140
```

```
Pro Val Phe Ala Val Ser Ser Arg Phe Phe Asn Ser Ile Thr Ser His
145                 150                 155                 160

Xaa Tyr Gly Arg Lys Xaa Glu Phe Asp Xaa Ile Ala Xaa Phe Leu Ile
                165                 170                 175

Cys Tyr Gln His Phe Thr Phe Tyr Pro Val Met Cys Val Ala Arg Val
            180                 185                 190

Asn Leu Tyr Leu Gln Thr Ile Leu Leu Leu Phe Ser Arg Xaa Lys Val
        195                 200                 205

Gln Asp Arg Ala Leu Asn Ile Met Gly Ile Leu Val Phe Trp Thr Trp
    210                 215                 220

Phe Leu Phe Leu Leu Ala Leu Leu Phe Val Pro Ile Gln His Ile Gln
225                 230                 235                 240

Phe Trp Leu Asn His Leu Ala Glu Asn Leu Tyr Xaa Gly
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<210> 7
<211> 1934
<212> DNA
<213> Glycine max

<400> 7

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<210> 8
<211> 450
<212> PRT
<213> Glycine max

<400> 8

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Lys Gly His Asn Lys Glu Gly Asp Leu Trp Ile Ser Ile Gln Gly Lys
             20                  25                  30

Val Tyr Asn Val Ser Asp Trp Val Lys Glu His Pro Gly Gly Asp Val
         35                  40                  45

Pro Ile Ser Asn Leu Ala Gly Gln Asp Val Thr Asp Ala Phe Ile Ala
     50                  55                  60

Tyr His Pro Gly Thr Ala Trp Ser His Leu Glu Lys Phe Phe Thr Gly
 65                  70                  75                  80

Tyr His Leu Ser Asp Phe Lys Val Ser Glu Val Ser Lys Asp Tyr Arg
                 85                  90                  95

Lys Leu Ala Ser Glu Phe Ser Lys Leu Gly Leu Phe Asp Thr Lys Gly
            100                 105                 110

His Val Thr Ser Cys Thr Leu Ala Ser Val Ala Val Met Phe Leu Ile
        115                 120                 125

Val Leu Tyr Gly Val Leu Arg Cys Thr Ser Val Trp Ala His Leu Gly
    130                 135                 140

Ser Gly Met Leu Leu Gly Leu Leu Trp Met Gln Ser Ala Tyr Val Gly
145                 150                 155                 160

His Asp Ser Gly His Tyr Val Val Met Thr Thr Asn Gly Phe Asn Lys
                165                 170                 175

Val Ala Gln Ile Leu Ser Gly Asn Cys Leu Thr Gly Ile Ser Ile Ala
            180                 185                 190

Trp Trp Lys Trp Thr His Asn Ala His His Ile Ala Cys Asn Ser Leu
        195                 200                 205

Asp His Asp Pro Asp Leu Gln His Met Pro Val Phe Ala Val Ser Ser
    210                 215                 220

Arg Phe Phe Asn Ser Ile Thr Ser His Phe Tyr Gly Arg Lys Leu Glu
225                 230                 235                 240

Phe Asp Phe Ile Ala Arg Phe Leu Ile Cys Tyr Gln His Phe Thr Phe
                245                 250                 255

Tyr Pro Val Met Cys Val Ala Arg Val Asn Leu Tyr Leu Gln Thr Ile
            260                 265                 270

Leu Leu Leu Phe Ser Arg Arg Lys Val Gln Asp Arg Ala Leu Asn Ile
        275                 280                 285
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```
Met Gly Ile Leu Val Phe Trp Thr Trp Phe Pro Leu Leu Val Ser Cys
    290                 295                 300

Leu Pro Asn Trp Pro Glu Arg Val Met Phe Val Leu Ala Ser Phe Ala
305                 310                 315                 320

Val Cys Ser Ile Gln His Ile Gln Phe Cys Leu Asn His Phe Ala Ala
                325                 330                 335

Asn Val Tyr Val Gly Pro Pro Ser Gly Asn Asp Trp Phe Glu Lys Gln
            340                 345                 350

Thr Ser Gly Thr Leu Asp Ile Ser Cys Ala Ser Ser Met Asp Trp Phe
        355                 360                 365

Phe Gly Gly Leu Gln Phe Gln Leu Glu His His Leu Phe Pro Arg Leu
    370                 375                 380

Pro Arg Cys Gln Leu Arg Lys Ile Ser Pro Leu Val Ser Asp Leu Cys
385                 390                 395                 400

Lys Lys His Asn Leu Pro Tyr Arg Ser Leu Ser Phe Trp Glu Ala Asn
                405                 410                 415

Gln Trp Thr Ile Arg Thr Leu Arg Thr Ala Ala Leu Gln Ala Arg Asp
            420                 425                 430

Leu Thr Asn Pro Ala Pro Lys Asn Leu Leu Trp Glu Ala Val Asn Thr
        435                 440                 445

His Gly
    450
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<210> 9
<211> 1972
<212> DNA
<213> Triticum aestivum

<400> 9

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gactccggcc accaccaaat caccaggcac cccgcgctca accgcctcct gcaggtggtc  720
tccgggaact gcctcaccgg cctcggcatc gcctggtgga agttcaacca caacacacac  780
cacatctcct gcaacagcct cgaccatgac ccggacctcc agcacttgcc gctcttcgcg  840
gtttccacca agctcttcaa caacctttgg tcggtctgct acgagcgcac cttggcgttt  900
gatgccatat ccaagttctt cgtcagctac cagcactgga cattctaccc ggtgatggga  960
tttgcaagga taaatcttct tgtgcagtca atcgtgttcc tgatcacgca aaagaaggtg 1020
cggcagcgtt ggctggagat cgccggagtt gcagcgttct gggtttggta ccccttgctg 1080
gtctcttgcc tgccgaattg gtgggagagg gttgcttttg tgcttgcaag ctttgtgatc 1140
acggggattc agcatgttca gttctgcctg aaccacttct catccgctgt gtatgttggg 1200
```

```
ccaccaaagg ggaacgactg gtttgagagg caaacagcgg gcacacttga tatcaagtgc 1260
tccccgtgga tggattggtt ccatggtggt ctgcagttcc aggttgaaca ccatttgttt 1320
cctcgcctgc ctcgctgcca ctataggatg gtcgcgccga ttgtgcgtga cctttgcaag 1380
aagcatgggc tgtcttatgg tgccgccaca ttctgggagg caaatgtaat gacatggaag 1440
acgctaaggg ctgcagcatt gcaggccagg gaagccacta ctggagctgc tccaaagaat 1500
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atattgatcc ttttagctgt tggaatcgtg ttggattttt cgtgttgcca ggtgactatc 1680
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ttgggttctc cctatcatgg taactacatc aatagtactt gatttacatc ataaaatccg 1800
tggcttatct ttacatccat ttcattttgc ttgcaagttc atgaaactgt aaactcaatt 1860
gatggtttgt agcgtgtata tcctgctgct atggcagctt gaactgcatt ttgggaacat 1920
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```

<210> 10
<211> 469
<212> PRT
<213> Triticum aestivum

<400> 10

```
Met Ala Arg Thr Gly Leu Ala Asp Ala Thr Ala Pro Glu Ala Asp Ala
  1               5                  10                  15

Met Pro Ala Ala Ser Lys Asp Ala Ala Asp Val Arg Met Ile Ser Thr
             20                  25                  30

Lys Glu Leu Gln Ala His Ala Ala Ala Asp Asp Leu Trp Ile Ser Ile
         35                  40                  45

Ser Gly Asp Val Tyr Asp Val Thr Pro Trp Leu Arg His His Pro Gly
     50                  55                  60

Gly Glu Val Pro Leu Ile Thr Leu Ala Gly Gln Asp Ala Thr Asp Ala
 65                  70                  75                  80

Phe Met Ala Tyr His Pro Pro Ser Val Arg Pro Leu Leu Arg Arg Phe
                85                  90                  95

Phe Val Gly Arg Leu Ser Asp Tyr Thr Val Pro Pro Ala Ser Ala Asp
            100                 105                 110

Phe Arg Arg Leu Leu Ala Gln Leu Ser Ser Ala Gly Leu Phe Glu Arg
        115                 120                 125

Val Gly His Thr Pro Lys Phe Leu Leu Val Ala Met Ser Val Leu Phe
    130                 135                 140

Cys Ile Ala Leu Tyr Cys Val Leu Ala Cys Ser Ser Thr Gly Ala His
145                 150                 155                 160

Met Phe Ala Gly Gly Leu Ile Gly Phe Ile Trp Ile Gln Ser Gly Trp
                165                 170                 175

Ile Gly His Asp Ser Gly His His Gln Ile Thr Arg His Pro Ala Leu
            180                 185                 190

Asn Arg Leu Leu Gln Val Val Ser Gly Asn Cys Leu Thr Gly Leu Gly
        195                 200                 205
```

```
Ile Ala Trp Trp Lys Phe Asn His Asn Thr His His Ile Ser Cys Asn
    210                 215                 220

Ser Leu Asp His Asp Pro Asp Leu Gln His Leu Pro Leu Phe Ala Val
225                 230                 235                 240

Ser Thr Lys Leu Phe Asn Asn Leu Trp Ser Val Cys Tyr Glu Arg Thr
                245                 250                 255

Leu Ala Phe Asp Ala Ile Ser Lys Phe Phe Val Ser Tyr Gln His Trp
            260                 265                 270

Thr Phe Tyr Pro Val Met Gly Phe Ala Arg Ile Asn Leu Leu Val Gln
        275                 280                 285

Ser Ile Val Phe Leu Ile Thr Gln Lys Lys Val Arg Gln Arg Trp Leu
    290                 295                 300

Glu Ile Ala Gly Val Ala Ala Phe Trp Val Trp Tyr Pro Leu Leu Val
305                 310                 315                 320

Ser Cys Leu Pro Asn Trp Trp Glu Arg Val Ala Phe Val Leu Ala Ser
                325                 330                 335

Phe Val Ile Thr Gly Ile Gln His Val Gln Phe Cys Leu Asn His Phe
            340                 345                 350

Ser Ser Ala Val Tyr Val Gly Pro Pro Lys Gly Asn Asp Trp Phe Glu
        355                 360                 365

Arg Gln Thr Ala Gly Thr Leu Asp Ile Lys Cys Ser Pro Trp Met Asp
    370                 375                 380

Trp Phe His Gly Gly Leu Gln Phe Gln Val Glu His His Leu Phe Pro
385                 390                 395                 400

Arg Leu Pro Arg Cys His Tyr Arg Met Val Ala Pro Ile Val Arg Asp
                405                 410                 415

Leu Cys Lys Lys His Gly Leu Ser Tyr Gly Ala Ala Thr Phe Trp Glu
            420                 425                 430

Ala Asn Val Met Thr Trp Lys Thr Leu Arg Ala Ala Ala Leu Gln Ala
        435                 440                 445

Arg Glu Ala Thr Thr Gly Ala Ala Pro Lys Asn Leu Val Trp Glu Ala
    450                 455                 460

Leu Asn Thr His Gly
465
```

<210> 11
<211> 448
<212> PRT
<213> Borago officinalis

<400> 11

```
Met Ala Ala Gln Ile Lys Lys Tyr Ile Thr Ser Asp Glu Leu Lys Asn
  1               5                  10                  15
```

```
His Asp Lys Pro Gly Asp Leu Trp Ile Ser Ile Gln Gly Lys Ala Tyr
            20                  25                  30

Asp Val Ser Asp Trp Val Lys Asp His Pro Gly Gly Ser Phe Pro Leu
        35                  40                  45

Lys Ser Leu Ala Gly Gln Glu Val Thr Asp Ala Phe Val Ala Phe His
    50                  55                  60

Pro Ala Ser Thr Trp Lys Asn Leu Asp Lys Phe Phe Thr Gly Tyr Tyr
65                  70                  75                  80

Leu Lys Asp Tyr Ser Val Ser Glu Val Ser Lys Asp Tyr Arg Lys Leu
                85                  90                  95

Val Phe Glu Phe Ser Lys Met Gly Leu Tyr Asp Lys Lys Gly His Ile
            100                 105                 110

Met Phe Ala Thr Leu Cys Phe Ile Ala Met Leu Phe Ala Met Ser Val
        115                 120                 125

Tyr Gly Val Leu Phe Cys Glu Gly Val Leu Val His Leu Phe Ser Gly
    130                 135                 140

Cys Leu Met Gly Phe Leu Trp Ile Gln Ser Gly Trp Ile Gly His Asp
145                 150                 155                 160

Ala Gly His Tyr Met Val Val Ser Asp Ser Arg Leu Asn Lys Phe Met
                165                 170                 175

Gly Ile Phe Ala Ala Asn Cys Leu Ser Gly Ile Ser Ile Gly Trp Trp
            180                 185                 190

Lys Trp Asn His Asn Ala His His Ile Ala Cys Asn Ser Leu Glu Tyr
        195                 200                 205

Asp Pro Asp Leu Gln Tyr Ile Pro Phe Leu Val Val Ser Ser Lys Phe
    210                 215                 220

Phe Gly Ser Leu Thr Ser His Phe Tyr Glu Lys Arg Leu Thr Phe Asp
225                 230                 235                 240

Ser Leu Ser Arg Phe Phe Val Ser Tyr Gln His Trp Thr Phe Tyr Pro
                245                 250                 255

Ile Met Cys Ala Ala Arg Leu Asn Met Tyr Val Gln Ser Leu Ile Met
            260                 265                 270

Leu Leu Thr Lys Arg Asn Val Ser Tyr Arg Ala His Glu Leu Leu Gly
        275                 280                 285

Cys Leu Val Phe Ser Ile Trp Tyr Pro Leu Leu Val Ser Cys Leu Pro
    290                 295                 300

Asn Trp Gly Glu Arg Ile Met Phe Val Ile Ala Ser Leu Ser Val Thr
305                 310                 315                 320

Gly Met Gln Gln Val Gln Phe Ser Leu Asn His Phe Ser Ser Ser Val
                325                 330                 335
```

```
Tyr Val Gly Lys Pro Lys Gly Asn Asn Trp Phe Glu Lys Gln Thr Asp
            340                 345                 350

Gly Thr Leu Asp Ile Ser Cys Pro Pro Trp Met Asp Trp Phe His Gly
        355                 360                 365

Gly Leu Gln Phe Gln Ile Glu His His Leu Phe Pro Lys Met Pro Arg
    370                 375                 380

Cys Asn Leu Arg Lys Ile Ser Pro Tyr Val Ile Glu Leu Cys Lys Lys
385                 390                 395                 400

His Asn Leu Pro Tyr Asn Tyr Ala Ser Phe Ser Lys Ala Asn Glu Met
                405                 410                 415

Thr Leu Arg Thr Leu Arg Asn Thr Ala Leu Gln Ala Arg Asp Ile Thr
            420                 425                 430

Lys Pro Leu Pro Lys Asn Leu Val Trp Glu Ala Leu His Thr His Gly
        435                 440                 445
```

<210> 12
<211> 469
<212> PRT
<213> Triticum aestivum

<400> 12

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Met Ala Arg Thr Gly Leu Ala Asp Ala Thr Ala Pro Glu Ala Asp Ala
  1               5                  10                  15

Met Pro Ala Ala Ser Lys Asp Ala Ala Asp Val Arg Met Ile Ser Thr
             20                  25                  30

Lys Glu Leu Gln Ala His Ala Ala Ala Asp Asp Leu Trp Ile Ser Ile
         35                  40                  45

Ser Gly Asp Val Tyr Asp Val Thr Pro Trp Leu Arg His His Pro Gly
     50                  55                  60

Gly Glu Val Pro Leu Ile Thr Leu Ala Gly Gln Asp Ala Thr Asp Ala
 65                  70                  75                  80

Phe Met Ala Tyr His Pro Pro Ser Val Arg Pro Leu Leu Arg Arg Phe
                 85                  90                  95

Phe Val Gly Arg Leu Thr Asp Tyr Thr Val Pro Pro Ala Ser Ala Asp
             100                 105                 110

Phe Arg Arg Leu Leu Ala Gln Leu Ser Ser Ala Gly Leu Phe Glu Arg
         115                 120                 125

Val Gly His Thr Pro Lys Phe Leu Leu Val Ala Met Ser Val Leu Phe
    130                 135                 140

Cys Ile Ala Leu Tyr Cys Val Leu Ala Cys Ser Ser Thr Gly Ala His
145                 150                 155                 160

Met Phe Ala Gly Gly Leu Ile Gly Phe Ile Trp Ile Gln Ser Gly Trp
                165                 170                 175
```

```
Ile Gly His Asp Ser Gly His His Gln Ile Thr Arg His Pro Ala Leu
            180                 185                 190

Asn Arg Leu Leu Gln Val Val Ser Gly Asn Cys Leu Thr Gly Leu Gly
        195                 200                 205

Ile Ala Trp Trp Lys Phe Asn His Asn Thr His His Ile Ser Cys Asn
    210                 215                 220

Ser Leu Asp His Asp Pro Asp Leu Gln His Leu Pro Leu Phe Ala Val
225                 230                 235                 240

Ser Thr Lys Leu Phe Asn Asn Leu Trp Ser Val Cys Tyr Glu Arg Thr
                245                 250                 255

Leu Ala Phe Asp Ala Ile Ser Lys Phe Phe Val Ser Tyr Gln His Trp
            260                 265                 270

Thr Phe Tyr Pro Val Met Gly Phe Ala Arg Ile Asn Leu Leu Val Gln
        275                 280                 285

Ser Ile Val Phe Leu Ile Thr Gln Lys Lys Val Arg Gln Arg Trp Leu
    290                 295                 300

Glu Ile Ala Gly Val Ala Ala Phe Trp Val Trp Tyr Pro Leu Leu Val
305                 310                 315                 320

Ser Cys Leu Pro Asn Trp Trp Glu Arg Val Ala Phe Val Leu Ala Ser
                325                 330                 335

Phe Val Ile Thr Gly Ile Gln His Val Gln Phe Cys Leu Asn His Phe
            340                 345                 350

Ser Ser Ala Val Tyr Val Gly Pro Pro Lys Gly Asn Asp Trp Phe Glu
        355                 360                 365

Arg Gln Thr Ala Gly Thr Leu Asp Ile Lys Cys Ser Pro Trp Met Asp
    370                 375                 380

Trp Phe His Gly Gly Leu Gln Phe Gln Val Glu His His Leu Phe Pro
385                 390                 395                 400

Arg Leu Pro Arg Cys His Tyr Arg Met Val Ala Pro Ile Val Arg Asp
                405                 410                 415

Leu Cys Lys Lys His Gly Leu Ser Tyr Gly Ala Ala Thr Phe Trp Glu
            420                 425                 430

Ala Asn Val Met Thr Trp Lys Thr Leu Arg Ala Ala Ala Leu Gln Ala
        435                 440                 445

Arg Glu Ala Thr Thr Gly Ala Ala Pro Lys Asn Leu Val Trp Glu Ala
    450                 455                 460

Leu Asn Thr His Gly
465
```

<210> 13
<211> 458

<212> PRT
<213> Helianthus annuus

<400> 13

```
Met Val Ser Pro Ser Ile Glu Val Leu Asn Ser Ile Ala Asp Gly Lys
 1               5                  10                  15

Lys Tyr Ile Thr Ser Lys Glu Leu Lys Lys His Asn Asn Pro Asn Asp
            20                  25                  30

Leu Trp Ile Ser Ile Leu Gly Lys Val Tyr Asn Val Thr Glu Trp Ala
        35                  40                  45

Lys Glu His Pro Gly Gly Asp Ala Pro Leu Ile Asn Leu Ala Gly Gln
    50                  55                  60

Asp Val Thr Asp Ala Phe Ile Ala Phe His Pro Gly Thr Ala Trp Lys
65                  70                  75                  80

His Leu Asp Lys Leu Phe Thr Gly Tyr His Leu Lys Asp Tyr Gln Val
                85                  90                  95

Ser Asp Ile Ser Arg Asp Tyr Arg Lys Leu Ala Ser Glu Phe Ala Lys
            100                 105                 110

Ala Gly Met Phe Glu Lys Lys Gly His Gly Val Ile Tyr Ser Leu Cys
        115                 120                 125

Phe Val Ser Leu Leu Leu Ser Ala Cys Val Tyr Gly Val Leu Tyr Ser
    130                 135                 140

Gly Ser Phe Trp Ile His Met Leu Ser Gly Ala Ile Leu Gly Leu Ala
145                 150                 155                 160

Trp Met Gln Ile Ala Tyr Leu Gly His Asp Ala Gly His Tyr Gln Met
                165                 170                 175

Met Ala Thr Arg Gly Trp Asn Lys Phe Ala Gly Ile Phe Ile Gly Asn
            180                 185                 190

Cys Ile Thr Gly Ile Ser Ile Ala Trp Trp Lys Trp Thr His Asn Ala
        195                 200                 205

His His Ile Ala Cys Asn Ser Leu Asp Tyr Asp Pro Asp Leu Gln His
    210                 215                 220

Leu Pro Met Leu Ala Val Ser Ser Lys Leu Phe Asn Ser Ile Thr Ser
225                 230                 235                 240

Val Phe Tyr Gly Arg Gln Leu Thr Phe Asp Pro Leu Ala Arg Phe Phe
                245                 250                 255

Val Ser Tyr Gln His Tyr Leu Tyr Tyr Pro Ile Met Cys Val Ala Arg
            260                 265                 270

Val Asn Leu Tyr Leu Gln Thr Ile Leu Leu Leu Ile Ser Lys Arg Lys
        275                 280                 285

Ile Pro Asp Arg Gly Leu Asn Ile Leu Gly Thr Leu Ile Phe Trp Thr
    290                 295                 300
```

```
Trp Phe Pro Leu Leu Val Ser Arg Leu Pro Asn Trp Pro Glu Arg Val
305                 310                 315                 320

Ala Phe Val Leu Val Ser Phe Cys Val Thr Gly Ile Gln His Ile Gln
                325                 330                 335

Phe Thr Leu Asn His Phe Ser Gly Asp Val Tyr Val Gly Pro Pro Lys
            340                 345                 350

Gly Asp Asn Trp Phe Glu Lys Gln Thr Arg Gly Thr Ile Asp Ile Ala
        355                 360                 365

Cys Ser Ser Trp Met Asp Trp Phe Phe Gly Gly Leu Gln Phe Gln Leu
    370                 375                 380

Glu His His Leu Phe Pro Arg Leu Pro Arg Cys His Leu Arg Ser Ile
385                 390                 395                 400

Ser Pro Ile Cys Arg Glu Leu Cys Lys Lys Tyr Asn Leu Pro Tyr Val
                405                 410                 415

Ser Leu Ser Phe Tyr Asp Ala Asn Val Thr Thr Leu Lys Thr Leu Arg
            420                 425                 430

Thr Ala Ala Leu Gln Ala Arg Asp Leu Thr Asn Pro Ala Pro Gln Asn
        435                 440                 445

Leu Ala Trp Glu Ala Phe Asn Thr His Gly
    450                 455
```

<210> 14
<211> 38
<212> DNA
<213> Artificial Sequence

<220>
<223> Definition of Artificial Sequence:PCR primer for 5′ of pk0011.d5

<400> 14
tttgcggccg caaatcaatg gaagaagcaa agaag 35

<210> 15
<211> 33
<212> DNA
<213> Artificial Sequence

<220>
<223> Definition of Sequence: antisense PCR primer for 3′ of pk0011.d5

<400> 15
tttgcggccg ccaggattca cccgaaagtg ttc 33

<210> 16
<211> 823
<212> DNA
<213> Triticum aestivum

<220>
<221> unsure
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<220>
<221> unsure
<222> (538)

<220>
<221> unsure
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<220>
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<221> unsure
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<220>
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<220>
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<220>
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<220>
<221> unsure
<222> (807)

<400> 16
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cttcctcctg agtcctgacc acccctcctc gcgctccagc taaatccacg ccaccgatgg 120
cccgcacggg cttcgcggac gcaacggcgc cggaagccga cgcaatgccg gccgccagca 180
aggacgccgc cgacgtccgc atgatctcca ccaaggagct gcaggcgcac gccgccgcgg 240
acgacctctg gatctccatc tccggggacg tctacgacgt cacgccctgg ctgcgccacc 300
acccgggcgg cgaggtcccg ctcatcaccc tcgccggcca ggacgccacc gacgccttca 360
tggcctacca cccgccctcc gtgcgcccgc tcctccgccg cttcttcgtc ggccgcctca 420

ccgactacac tgtccccccc gcctccgccg acttccgccg cctcctcgcg cagctctcct 480
ccgcgggcct cttcgagcgc gtcggcacac ccccaagttc ctgctcgtcg caaagtcngt 540
gctcttctgc atcggcctct actgctcctc gcctgctcaa caccggggcc acatgttcgc 600
cgggggctca ttggcttatc tggtcagtcg ggctggattg gcatactccg gcacacaaat 660
cacaggcacc tgcctcaacg ctctgnagtg gctcgggaat gctnacggct cggatcnctg 720
gggagtnanc acacaanaca nattctgaan ngtcacatac ctgactcana ttccgtntcg 780
ggtcacaagt ctaaaacttg catcgtnaag acttggttag cat 823

<210> 17
<211> 114
<212> PRT
<213> Triticum aestivum

<400> 17

Met	Pro	Ala	Ala	Ser	Lys	Asp	Ala	Ala	Asp	Val	Arg	Met	Ile	Ser	Thr
1				5				10					15		
Lys	Glu	Leu	Gln	Ala	His	Ala	Ala	Ala	Asp	Asp	Leu	Trp	Ile	Ser	Ile
			20					25					30		
Ser	Gly	Asp	Val	Tyr	Asp	Val	Thr	Pro	Trp	Leu	Arg	His	His	Pro	Gly
		35					40					45			
Gly	Glu	Val	Pro	Leu	Ile	Thr	Leu	Ala	Gly	Gln	Asp	Ala	Thr	Asp	Ala
	50					55					60				
Phe	Met	Ala	Tyr	His	Pro	Pro	Ser	Val	Arg	Pro	Leu	Leu	Arg	Arg	Phe
65					70					75					80
Phe	Val	Gly	Arg	Leu	Thr	Asp	Tyr	Thr	Val	Pro	Pro	Ala	Ser	Ala	Asp
				85					90					95	
Phe	Arg	Arg	Leu	Leu	Ala	Gln	Leu	Ser	Ser	Ala	Gly	Leu	Phe	Glu	Arg
			100					105					110		
Val	Gly														